

Fire-dependent Ecosystem Restoration Project

Detailed Purpose and Need and Proposed Action for Scoping – January 2022

Project Area

The analysis area is on the Chippewa National Forest (CNF) and completely within the proclamation boundary of the Leech Lake Band of Ojibwe Reservation (LLBO) encompassing approximately 778,000 acres, including 291,000 acres of National Forest System lands (Figure 1).

¹Within the analysis area there are approximately 150,000 acres of National Forest System lands that are classified as fire-dependent ecosystems, which would be the priority for treatment. Fire-dependent ecosystems were identified by querying Ecological Landtypes (ELTs) via Geographic Information System (GIS). Table 1 and Table 2 display ownership and fire-dependent ELTs within the analysis area.

Table 1: Project Boundary Ownership (Acres)

Owner	Acres
Beltrami County	2,135
Cass County	14,304
Itasca County	3,782
LLBO	24,305
Other	100,888
State	124,199
USDA Forest Service	290,824
Water	218,098
Total	778,535

Table 2: Fire-Dependent (FD) ELTs within the Project Area¹

Land Type	Total Acres	NFS Acres
FD Great Lakes Pine	7,711	4,340
FD Jack Pine	14,954	10,476
FD Mixed Pine/Hardwood	92,178	59,989
FD Red Pine	112,095	72,679
FD Wet Meadow	19,584	5,901
Totals	246,522	153,385

¹ - These fire-dependent ELTs tend to be dry, sand-based systems comprised of predominately upland fire-dependent forest types. However, the landscape does contain inclusions of forests less dependent on fire, particularly in wet lowlands and fire shadows east of large lakes.

¹¹¹ On December 23, 2020, the President signed into law S.199, the *Leech Lake Band of the Ojibwe Reservation Restoration Act (Act)*. This Act transfers more than 11,000 acres of land administered by the Chippewa National Forest to be held in trust by the Department of the Interior for the benefit of the Leech Lake Band of the Ojibwe. Some of these land transfers may occur within the project boundary which may reduce the number of acres receiving the proposed prescribed burning.

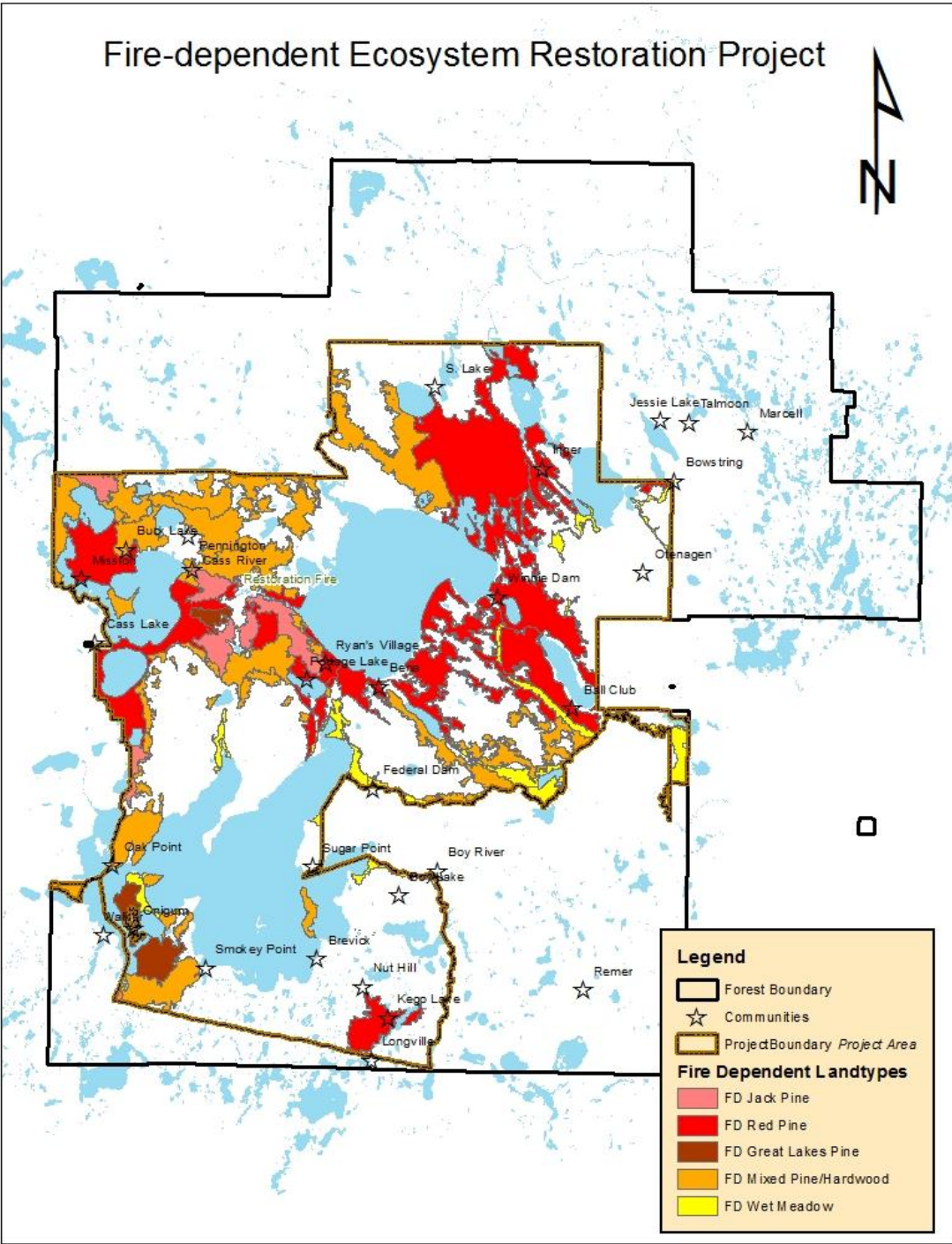


Figure 1: Map of the fire-dependent ELTs that would be prioritized for treatment within the proposed project boundary (within the LLBO reservation boundary)

Purpose and Need

This project was developed to respond to desired conditions and needs defined by:

- The 2004 Chippewa National Forest Land and Resource Management Plan (Forest Plan).
- The fiduciary responsibility of the USDA Forest Service to protect and enhance resources on National Forest System lands within Reservation boundaries under Leech Lake Band of Ojibwe's (LLBO) usufructuary Treaty Rights of hunting, fishing, gathering.
- The October 4, 2019 Memorandum of Understanding between the USDA Forest Service, Chippewa National Forest, and the Leech Lake Band of Ojibwe of the Minnesota Chippewa Tribe (MOU).
- The 2020 Tribal Forest Protection Act request submitted by LLBO, regarding fire dependent stands and climate change.

Each of these are discussed further in the sections that follow.

Forest Plan Management Direction

The Chippewa National Forest Plan provides the following forest wide management direction relevant to restoring fire-dependent communities and associated wildlife habitats:

- D-ID-5 Fire is present on the landscape, restoring or maintaining desirable attributes, processes, and functions of natural communities.
- O-ID-2 Establish, maintain, or improve the condition of vegetation conditions using prescribed fire, mechanical treatments, and other tools.
- D-VG-3 Vegetation (live and dead) is present in amounts, distributions, and characteristics that are representative of the spectrum of environmental conditions that would have resulted from the natural cycles, processes, and disturbances under which current forest ecosystems and their accompanying biological diversity evolved. The ecosystem composition, structure, and process representation consider time frames, a variety of landscape scales, and current biological and physical environments. Resource conditions exist that minimize undesirable occurrences of non-native invasive species.
- O-VG-11 Increase amount of a variety of prescribed burning practices to restore the ecological process of fire and provide habitat for threatened and endangered species and other wildlife that benefit from or require burned vegetation.
- O-WL-26 The amount and distribution of dead and dying trees should provide adequate representation of patterns and amounts that would result from natural disturbances (such as fire and flooding) and other ecological processes (such as insect and disease infestation and vegetation succession). If natural disturbances do not provide adequate habitat, it may be necessary to emulate natural disturbances through management ignited fire or other treatments.
- D-TR-1 Lands within the Forest serve to help sustain American Indians' way of life, cultural integrity, social cohesion, and economic well-being.

- O-TR-5 The Forest Service will administer projects and programs to address and be sensitive to traditional Native American religious beliefs and practices.
- S-TR-5 Affected Tribes will be consulted regarding opportunities for restoration, enhancement, and maintenance of native plant communities and wildlife species, including threatened, endangered, sensitive, or rare species that are of interest to tribes. Where tribal interest is indicated, cooperative programs for restoration and/or maintenance of these communities/species will be established.
- G-TR-3 Plant and animal species of traditional use should be given consideration in any management project when desired and sought after by tribal members.

The following Forest Plan Management Areas fall within the project boundary:

Table 3: Project boundary management areas (acres of national forest system lands)

Management Area	Acres (NFS lands)
Candidate RNAs	1,133
Experimental Forest	6,437
General Forest	121,201
General Forest - Longer Rotation	98,471
Rec Use - Scenic Landscape	12,191
Research Natural Areas	1,926
Riparian Emphasis	21,775
Semi-primitive Non-motorized Recreation	6,854
Unique Biol/Aquatic/Geol/Hist	12,850
WATER	7,952
Total	290,790

The project boundary includes the Bear Island, Cut Foot Sioux Ranger Station, Farley Hill Esker and Lookout Station, Knutson Dam, Mississippi River Corridor, Sucker Bay, and Ten Section Unique Biological, Aquatic, Geological and Historic Areas. The Ten Section and Mississippi River Unique Biological Areas each contain approximate 5,000 acres of fire-dependent land types within the analysis area, others range from just 3 to 130 acres. The Forest Plan emphasizes the management of these areas for wildlife and native plant communities (D-UB-2, D-UB-6, D-UB-9) and allows for the use of prescribed fire to manage forest communities and maintain old growth or old forest (S-UB-1).

One Research Natural Area (RNA) and one candidate RNA are within the project boundary and contain fire-dependent land types proposed for treatment: Pine Point RNA (1,152 acres) and Sunken Lake candidate RNA (590 acres). According to the Forest Plan, prescribed fire or other deliberate manipulation may be used, in limited situations, to maintain the ecosystem or unique features for which the RNA was established or to reestablish natural ecological processes (D-RNA-2). Management emphasizes conserving or enhancing these ecosystems, and where appropriate, interpreting these areas for public education (D-RNA-1).

The analysis area also includes the Cutfoot Experimental Forest. The Forest Plan allows for prescribed fire and vegetation management in association with/consistent with research projects

(D-EF-4 and F-EF-1). A Research Scientist has been included as an ad hoc member of the interdisciplinary team to provide input.

Desired Vegetation Conditions for LLBO Reservation

The Forest Service and the Leech Lake Band of Ojibwe (LLBO) consult as government-to-government entities in managing National Forest System lands within the LLBO Reservation. The October 4, 2019 “Memorandum of Understanding between the USDA Forest Service, Chippewa National Forest and the Leech Lake Band of Ojibwe of the Minnesota Chippewa Tribe,” (MOU) outlines the process for consultation as well as the desired vegetation conditions (DVCs) for National Forest lands within the LLBO Reservation. The proposed project could support the following desired vegetation conditions/basic management priorities from our Memorandum of Understanding with LLBO (Appendix C).

- LL-DVC-1 Increase blocks of ecologically functioning old growth stands
- LL-DVC-3 Impacts to TES/TCPs are impacts to tribes cultural identify
- LL-DVC-5 Protecting the cultural integrity of the LLBO
- LL-DVC-7 Restore conifers to ecologically functioning systems

Chippewa National Forest Fire and Fuels staff have engaged for several months with LLBO Division of Resource Management staff about the concept to reintroduce fire to fire-dependent landscapes. In February 2020 the LLBO sent a letter to Forest Supervisor Darla Lenz requesting the Forest to work specifically on reintroducing fire within the boundary of the LLBO Reservation. This request was submitted under the Tribal Forest Protection Act (TFPA) and entitled “Tribal Government's Proposal Regarding Fire Dependent Stands and Climate Change.” The focus of the TFPA proposal is to increase prescribed burning to restore shorter fire return intervals as it relates to indigenous burning identified in the land management plan and to increase resistance and resilience of these ecosystems to climate change. This TFPA request was approved by the Regional Forester in June 2020, with support to increase pace and scale of prescribed fire in collaboration with LLBO and others, though with a reduced prescribed fire acreage goal due to existing management challenges.

We believe this proposal to reintroduce fire with additional mechanical or associated treatments is responsive to the TFPA request and promotes the desired vegetation management conditions expressed by the LLBO on National Forest System lands within the LLBO Reservation. We strive to incorporate LLBO citizens' traditional ecological knowledge to achieve desired conditions in the Forest Plan and MOU.

Need for Action

There is a need to restore fire-dependent land types, associated wildlife habitat, and cultural resources or uses. Fire-dependent native plant communities within the area historically had more frequent fire occurrences which maintained a more open structure and greater ground layer herbaceous cover and diversity. Currently, the total area and frequency of fires occurring within the project area is insufficient to maintain these natural conditions. Lack of fire results with increased canopy, sub-canopy, and shrub layer cover; and decreased herbaceous cover and diversity. These effects impact wildlife habitat components and, as noted in the recent Tribal Forest Protection Act request letter from the Leech Lake Band of Ojibwe, a “lack of fire in the present day has led to impacts on.... access to live and practice Ojibwe Lifeways.”

To remedy these impacts, we need to restore the structure and diversity of fire-dependent ecosystems through prescribed fire, mechanical treatments, and/or seeding/planting to sustain these land types in their desired condition for native plant communities, to improve associated wildlife habitat, and to maintain important cultural resources and culturally important species. There is a need to increase the pace and scale of prescribed fire on the landscape particularly in upland fire dependent communities. Over the last decade the Forest has increased the use of fire in upland fire dependent communities. We plan to demonstrate similar progress over the next decade. We also plan to continue discussions for opportunities with the Band for collaborative projects that are needed to reestablish the fire regimes that will support Fire Dependent Communities for cultural and ecological values.

Past prescribed burning projects have not been capable of achieving ecosystem restoration at the desired scale and have not been responsive to conditions as they develop, such as extensive flushing of shrub layers and/or a depauperate ground layer response to the opening of canopies. When these conditions develop, they detract from the desired structure and diversity objectives within fire-dependent communities. In a present closed-canopy state, burning alone may not be enough to restore fire-dependent ecosystems in a timely fashion. As such, complementary treatments of thinning, burning, and/or seeding/planting may be needed to increase understory light levels and re-establish diverse understory plant communities.

Consistent with the goals described in the approved TFPA request, bringing back burning in fire-dependent land types helps to maintain an array of forest structures, compositions, and community diversity, thus encouraging more resilient ecosystems that can more readily adapt to a changing climate (Brose, Schuler, Van Lear, & Berst, 2001).

Additional benefits of maintaining or re-establishing fire-dependent land types include reducing risk to communities from hazardous fuels, as noted in the Leech Lake Community Wildfire Protection Plan (CWPP) and Chippewa National Forest Hazard Fuels and Prescribed Fire Strategic Plan. Prescribed fire may have additional benefits for ongoing vegetation management such as preparing seed beds, increasing structural and compositional diversity, or reducing competition from shade-tolerant, fire sensitive trees; thus increasing the health and resilience of forested areas (Nowacki and Abrams 2008). Finally, there are opportunities in the project area to meet resource objectives while simultaneously providing wood products in support of local and regional economies and meeting Forest Plan-identified need to provide for a range of timber products.

Fire Disturbance

Recurrent fire has been documented over hundreds of years on the Chippewa National Forest, as well as the relatively abrupt end to fires during the onset of the 20th century when fire exclusion began (Figure 2). Local research found mean fire intervals of 9 years at Norway Beach to be much shorter than similar conditions elsewhere in Minnesota and posits that indigenous fire ignitions may have been integral to forest dynamics (Guyette, Gallagher, Dey, & Stambaugh, 2014). Relatively short mean fire intervals from 8 to 15 years were also found in the Cutfoot Experimental Forest of the Chippewa National Forest (Guyette, Richard; Gallagher, Theresa; Palik, Brian; Dey, Daniel; Stambaugh, Michael; and The Missouri Tree-Ring Laboratory, 2015). The predominance of frequent, low to moderate severity surface fires, punctuated by occasional stand-regenerating fires, is discussed below in relation to the project area (Minnesota Department of Natural Resources, 2003).

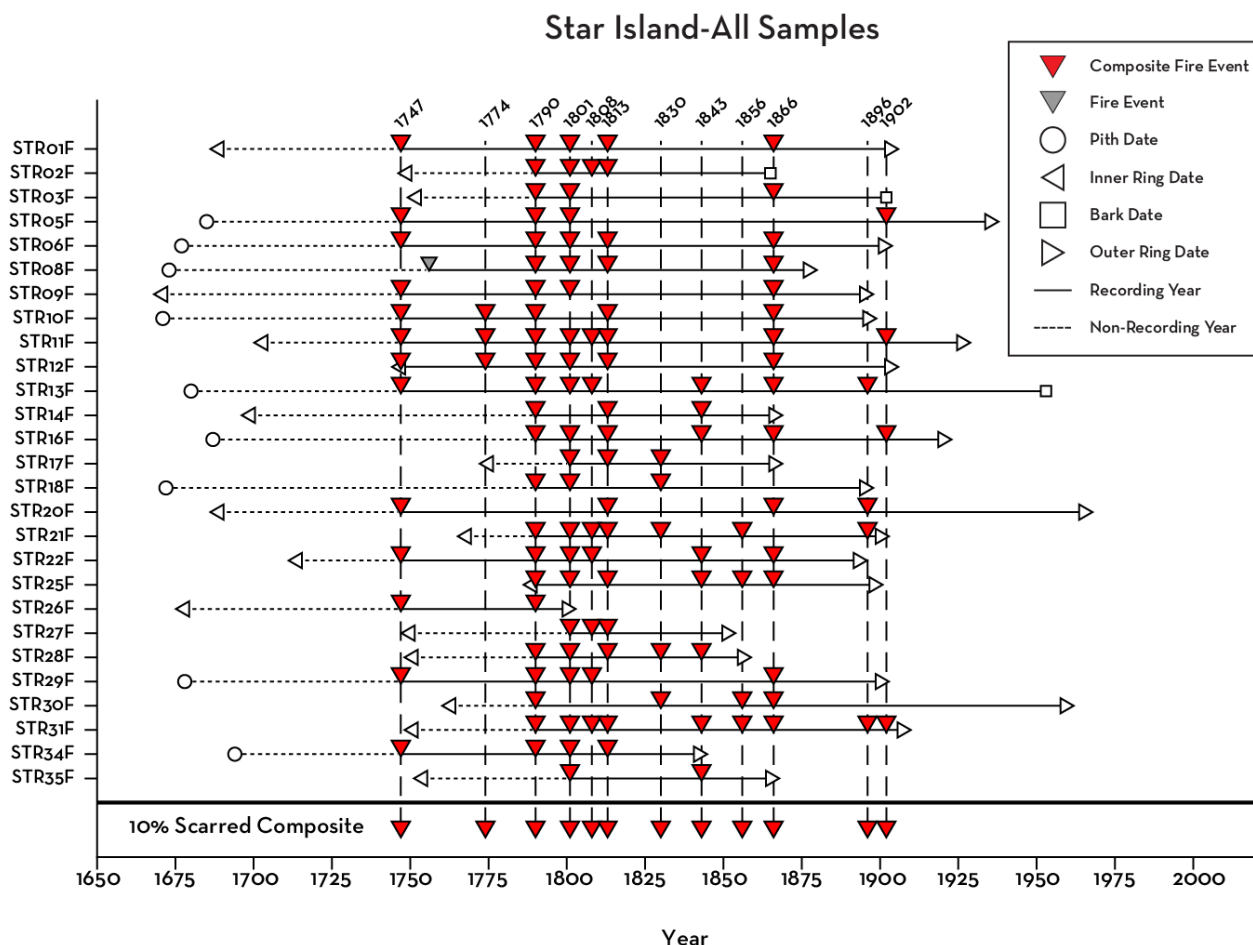


Figure 2: Historical fire events on Star Island, Minnesota (Kipfmüller, 2020)

Stand regenerating fires occurred on average about every 110 to 130 years in central fire-dependent forest types and about every 170 to 220 years in northern fire-dependent forest types (Minnesota Department of Natural Resources, 2003). Given the frequency of stand regenerating fires, and the approximate 150,000 acres of fire-dependent landscapes mapped in the Terrestrial Ecological Units Inventory (TEUI) on the Chippewa NF, it could be expected that about 700 to 1,300 acres of this area would have typically experienced a stand regenerating fire in any given year.

Stand regenerating fires resulted with preforest conditions, dominated by herbaceous and shrub vegetation, and tree regeneration, with some remnant canopy trees; these conditions are described by Brian Palik, Science Leader for Applied Forest Ecology with the USDA Forest Service Northern Research Station (Palik, D'Amato, Franklin, & Johnson, 2020). He describes preforest communities as consisting of regrowth from surviving plants (their rhizomes, roots, and stumps) as well as recruitment of annual and perennial herbaceous species that may initially dominate. These species transition towards forest canopy closure by a new cohort of tree species, a process in some stand types that may typically take up to five years but could exist for up to twenty years (Palik B. , 2020). Assuming preforest conditions lasted about five years, roughly 2 to 5 percent of fire-dependent community types could have existed as herbaceous/woodland systems given the average range of stand-replacing fires.

Maintenance fires, comprised of low-to-moderate severity surface burns, occurred much more frequently, from 22 to 25 years in central fire-dependent forests and from about 42 to 115 years in northern fire-dependent forest types (Minnesota Department of Natural Resources, 2003). With about 150,000 acres of fire-dependent communities on the Chippewa NF, we could expect that anywhere from about 1,300 to 7,000 acres may have historically experienced a moderate surface fire each year. With local data indicating that average fire intervals were as frequent as 8 to 15 years, even larger acreages of moderate surface fire were likely to have occurred on the Chippewa National Forest.

Fire-tolerant inclusions within the larger fire-dependent landscape may occur where advancing fires are restricted by increased soil moisture, topography, and waterbodies. Fire disturbances were less frequent in fire-tolerant stands, with average stand regenerating fires occurring from about every 370 to over 1,000 years and moderate surface fire occurring from about every 40 to 160 years (Minnesota Department of Natural Resources, 2003).

While some lowland plant communities are intolerant of fire, wet meadows and marshes were sustained or established by disturbance events such as fires or flooding. These communities are dominated by graminoids with tree species absent or existing with minimal cover.

The decrease in fire occurrence has modified the structure and composition of fire-dependent and fire-tolerant ecological communities across Minnesota (Hanberry, Palik, & He, 2012). This condition is affecting species adapted to fire regimes – including culturally important resources to the Leech Lake Band of Ojibwe. These resources consist of both Traditional Cultural Properties (TCP) as well as Threatened, Endangered, and Sensitive (TES) species, including Regional Forester Sensitive Species. Impacts to these species occur as fire-exclusion results with recruitment of fire-intolerant species and increasing sub-canopy and shrub cover that displaces TES/TCP ground and subshrub flora (e.g. *Botrychium* spp., *Vaccinium angustifolium*). Declines in woody debris and snags in uplands which would have resulted from fires decreases habitat availability to TES/TCP wildlife in uplands (e.g. Snowshoe hare, Black-backed woodpecker, and Olive-sided flycatcher) in addition to woody recruitment in lowlands which reduces habitat quality for species in wet meadows (e.g. Yellow-rail).

Proposed Action

This project proposes to conduct restoration treatments to include prescribed fire, canopy reduction, and associated activities within the project area boundary. The quantity of restoration treatment acres in a given program year could occur on several hundred to several thousand acres per year, depending on conditions, funding, and opportunities. Restoration treatments would not exceed 5,000 acres per year. Associated activities may include fire control line, machine mechanical treatments, hand mechanical treatments, and harvest treatments. The proposed activities could occur throughout the project area and the specific locations and treatment designs would be determined as part of the implementation process. The following sections describe the treatment area development process and the activities proposed in more detail.

Treatment Area Development

At this time, we have not identified specific stands, burn units or treatment units, but we have identified the types of fire-dependent ecosystems we anticipate may have a need for restoration actions within the project area (Figure 1). Other ongoing projects within the area, such as the West Zone Conifer Thin project, will have varied vegetative responses to management actions

depending on the diversity of existing vegetation and seed beds. As implementation of other projects are completed, an inventory of site-specific conditions could be conducted to assess the need for fire-dependent ecosystem restoration activities. Where existing vegetation results with explosive growth in the shrub layer cover and/or where the absence of natural disturbance for long periods of time has depleted the seed bed of fire-dependent diversity such that limited recruitment of fire-dependent ground layer flora results, the area would be considered for treatment activities.

Fire-dependent ecosystems are a landscape level feature of the Chippewa National Forest. Opportunities to develop treatment areas within harvests under other projects will need to be interwoven with additional treatment areas developed under this project to reach the desired condition at a landscape scale. Resource inventories outside of areas being actively managed under other projects may also reveal similarly developing conditions where the structure and diversity of fire dependent ecosystems are straying from that of the desired condition and the need for fire dependent ecosystem restoration activities. This could include excessive shrub layer development, depauperate fire-dependent ground layer diversity, as well as excessive canopy cover that inhibits the desired understory condition

The flow chart in Figure 3 shows the steps we would take to identify specific treatment areas, complete interdisciplinary resource reviews, notify stakeholders, and design the projects prior to implementation.

- **Site identification:** Once potential treatment areas are identified, site conditions would be reviewed, and we would use the criteria listed in Appendix A to determine which treatment types would be applied. The proposed action would be aimed to move composition and structure toward the range observed in historical conditions/desired community characteristics and increase resiliency of fire dependent ecosystems while considering adaptations for climate change (see Appendix A).
- **Resource review:** Once the locations are preliminarily approved, specific resource surveys and additional interdisciplinary coordination would be conducted after the decision. Depending on the location and the availability of existing information, this may include botanical survey, archeological survey, applying soils and water best management practices, coordination with LLBO Division of Resource Management, etc. These are described further in the design elements section. In addition, the team would use an implementation checklist to ensure compliance with the decision.
- **Notifications:** Public notification of the site-specific locations would be provided annually. Members of the public would be able to provide any new information or changed circumstances to the responsible official prior to implementation that is relevant to the site-specific location. This information would be reviewed, and a determination would be provided in a Supplemental Information Report that indicates whether the project remains within the scope and range of effects originally analyzed or whether additional environmental review would be needed. Public notification would also occur during implementation of prescribed fires.
- **Implementation and Monitoring:** Part of the implementation process is the development of monitoring protocols to gauge the accomplishment of objectives. Part of the management process is measuring vegetative response to treatments and adjusting for subsequent entries and treatments.

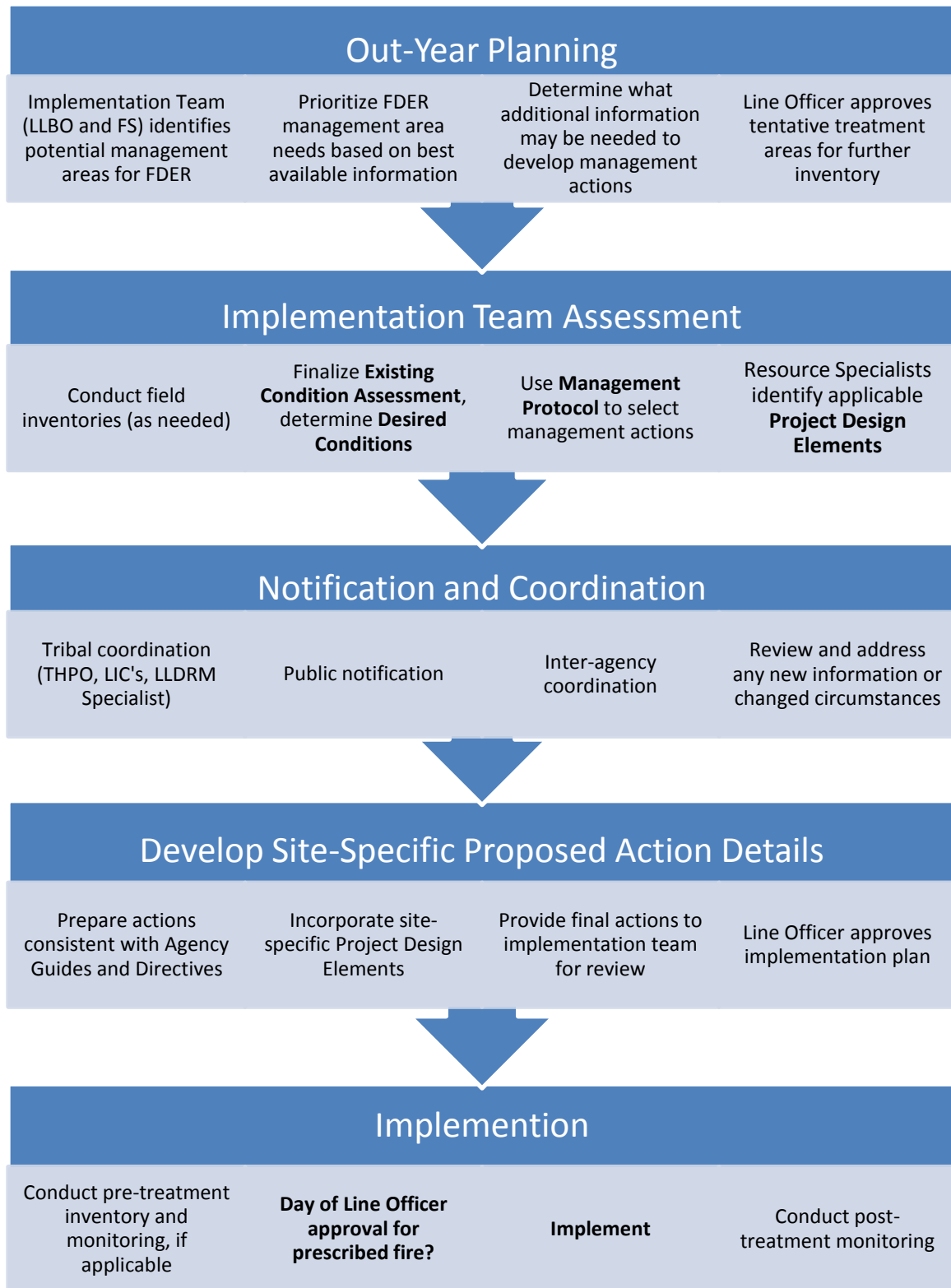


Figure 3: Site-specific Management Area Development Process (Items in Bold refer to guidance provided in Appendix A.)

Prescribed Fire

Prescribed fire may include but is not limited to broadcast burning, under-burning, or pile burning using hand ignition or aerial ignition. Prescribed burns could include single stand level treatments or multi-stand landscape level treatments that are burned in sub-units (10-500 acres in size). The timing of prescribed burning would depend on conditions, objectives, and coordination with treatments supported with other planning documents. While we have identified the potential priority fire-dependent land type areas based on current geospatial data available, specific conditions on the ground may differ from mapped conditions. We are proposing to use prescribed burning within and adjacent to these fire-dependent land types within the project boundary and where they need restoration to meet desired conditions. It is important to recognize prescribed fire and restoration treatments may play a role in fire dependent systems, fire intolerant systems, and even fire intolerant systems. Appendix A describes how to determine the land type or fire-tolerance to aid in determining which community characteristics are desired. It also describes the restoration treatment options that would be proposed depending on the location-specific conditions. Prescribed fire would be implemented in adherence with Agency policy and direction, following the Interagency Prescribed Fire Planning and Implementation Procedures Guide (PMS-484) (2017) which establishes national interagency standards. These standards describe what is acceptable for prescribed fire planning and implementation: provide consistent interagency guidance, common terms and definitions, and standardized procedures; make clear that firefighter and public safety is the first priority; ensure that risk management is incorporated into all prescribed fire planning and implementation; support safe, carefully planned, and cost-efficient prescribed fire operations; support the use of prescribed fire to reduce wildfire risk to communities, municipal watersheds and resources; and support the use of prescribed fire to restore natural ecological processes.



Figure 4: Application of prescribed fire

Fire Control Lines

In order to safely implement prescribed fire, fire control features or holding line construction would be needed. Existing features such as roadways, drainages, or other existing natural barriers would be used where possible. If that is not feasible, mechanical line is most often constructed with soft-tracked vehicles and a mulching head. Dozer lines, handlines, saw lines, and hose lays

are also utilized where necessary. Dozer line involves removal of vegetation exposing bare mineral soil. These control lines would vary in width depending on the conditions of the area, but typically are greater than six feet across. If road or trail is used it is desired that the tread exists of mineral soil one foot wide or greater. We would rehabilitate areas disturbed for fire control line. Hazard tree removal may also occur near roads, control lines, or in other areas where people will be working. Site-specific resource concerns related to placement of fire control lines would be addressed at implementation (see design features).

Other restoration tools and activities

In addition, to help meet restoration objectives, we propose additional activities. Machine or hand mechanical treatments could be used for removal of shrub growth (brushing) using various tools, including, but not limited to hydro-ax, hydraulic mulchers, mower heads, brush saws, chainsaws, or lopping shears. Planting, including site preparation (tilling, mowing, or other techniques), would be used to introduce native forbs, shrubs, and grasses. Also canopy cover may need to be reduced to meet desired conditions, to allow for reintroduction of fire, and for enhancing understory response to prescribed fire, depending on ecosystem type and condition. Canopy closure may be reduced through thinning, mechanical harvest, girdling or other means.

Up to 1 mile of low standard or temporary roads may be needed to provide access for restoration activities. These roads would be constructed to the lowest level road needed. Roads may be gated or obliterated and revegetated after use depending on the need for future access.



Figure 5: Equipment accessing treatment area

Design Elements

Design elements are additions to the proposed action used to minimize undesirable effects to natural and cultural resources that may result from the proposed action and to ensure consistency with the Forest Land and Resources Management Plan and other laws, regulations, and policy.

Table 4: Design elements for prescribed fire and associated activities, non-harvest (mechanical fuels treatments and Fireline)

Design Element	Activity that needs to be modified	Where? applicable area (geographic features, forest types, management areas, etc.)	When? Timing when element is needed.	Source/Reference/Code <i>S - Forest Plan Standard; G – Forest Plan Guideline; O – Forest Plan Objective; MFRC- Site-level Forest Management Guidelines; M - Mitigation; LL-DVC – LLBO desired vegetation condition</i>
General				
Develop site-specific treatment areas annually and provide public notification for their opportunity to provide any new information or changed circumstances for the specific areas to be considered by the responsible official.	All activities	All project areas	Annually	Project Specific
BOTANY				
When identifying management locations, consult with the forest botanist to ensure that a botanical survey has been conducted or is scheduled at least one year in advance of project implementation to allow for inventory of botanical resources and risks. The forest botanist may apply the following project design features depending on the result of project area survey.	All activities	All project areas	After an area has been identified for management with the potential actions authorized by this project.	O-WL-17 G-WL-11 LL-DVC-3
Where fire-dependent/tolerant regional forester sensitive species (RFSS) occur within management units, dormant season burning would be preferred over growing season burns.	Prescribed burning	Where RFSS occur	Growing season	O-WL-17 G-WL-11 LL-DVC-3

Chippewa National Forest – Fire Dependent Ecosystem Restoration Project – Detailed Proposed Action

Design Element	Activity that needs to be modified	Where? applicable area (geographic features, forest types, management areas, etc.)	When? Timing when element is needed.	Source/Reference/Code <i>S - Forest Plan Standard; G – Forest Plan Guideline; O – Forest Plan Objective; MFRC- Site-level Forest Management Guidelines; M - Mitigation; LL-DVC – LLBO desired vegetation condition</i>
During the growing season, exclude heavy equipment from areas populated by RFSS. Utilize hand equipment to achieve desired condition in growing season or conduct mechanical activity during frozen ground conditions.	Mechanical treatments	Where RFSS occur	Outside of frozen ground conditions	O-WL-17 G-WL-11 LL-DVC-3
Where fire-intolerant RFSS occur, exclude occupied habitat all activities	All activities	Where fire-intolerant RFSS occur	All seasons	O-WL-17 G-WL-11 LL-DVC-3
Utilize existing authority to suppress infestations of high priority non-native invasive species (NNIS) before activity occurs.	All activities	Occurrences of High Priority NNIS within Activity Units	Growing season	O-WL-38 O-WL-39 G-WL-25
Avoid infestations of NNIS to the greatest practical extent during project implementation	All activities	Occurrences of all Chippewa NF NNIS of concern	All seasons	O-WL-38 O-WL-39 G-WL-25
SOILS AND WATER				
Follow the Forest Service National Best Management Practices				USDA Forest Service 2012
To the extent possible leave 50% of the litter and duff when prescribed burning. There may be circumstances when greater than 50% consumption of Litter and Duff is desired to meet resource objectives.	Prescribed fire	All	All	BMP National guide Fire-2. Use of Prescribed Fire page 54 and 55.
When creating fire line down to mineral soil, place litter and duff on the unburned (green) side of the fire line to facilitate fireline rehabilitation.	Fireline	All	All	Forest Plan Standard Retain Soil Nutrients

Chippewa National Forest – Fire Dependent Ecosystem Restoration Project – Detailed Proposed Action

Design Element	Activity <i>that needs to be modified</i>	Where? <i>applicable area</i> <i>(geographic features, forest types, management areas, etc.)</i>	When? <i>Timing when element is needed.</i>	Source/Reference/Code <i>S - Forest Plan Standard; G – Forest Plan Guideline; O – Forest Plan Objective; MFRC- Site-level Forest Management Guidelines; M - Mitigation; LL-DVC – LLBO desired vegetation condition</i>
Restrict equipment traffic throughout the treatment area to periods when soils are dry or frozen to depth of 4 inches or more (consult with soil scientist).	Mechanical activities and fireline	Winter-restricted soils/wetter soil types	Limit activities when soils are wet	Forest Plan Standard Minimize Soil Compaction
When designing unit layout, use existing roads, trails, and natural holding features to the extent possible. Avoid placing infrastructure within riparian management zones, wetlands, and filter strips.	Firelines	All	All	MFRC and Forest Plan Standard Maintain Soil Productivity
To the extent that it's practical, follow slope contours and minimize long, straight paths that channel water. Divert water using techniques such as broad-based dips, lead-off ditches, or water bars.	Timber harvest activities	Everywhere	All	Forest Plan Standard Minimize Soil Erosion
Use existing roads, skid trails, and log landings to the extent that it's practical and limit equipment traffic off skid trails to < 30% of the treatment area. Roads and log landings should occupy no more than: 1 acre for treatments <20 acres, 5% of the treatment area for treatments 20-30 acres, or 3% of the treatment area for treatments >30 acres. Skid trails should occupy < 15% of the treatment area, regardless of treatment area size. Avoid placing infrastructure within riparian management zones, wetlands, and filter strips.	Timber harvest activities	Everywhere	All	MFRC and Standard in Forest Plan
When treatments have been completed: obliterate and close constructed fire control lines, close temporary roads remove temporary fill and crossing structures, and	Fireline	Everywhere	All	Forest Plan Standard Maintain Soil Productivity

Chippewa National Forest – Fire Dependent Ecosystem Restoration Project – Detailed Proposed Action

Design Element	Activity that needs to be modified	Where? applicable area (geographic features, forest types, management areas, etc.)	When? Timing when element is needed.	Source/Reference/Code <i>S - Forest Plan Standard; G – Forest Plan Guideline; O – Forest Plan Objective; MFRC- Site-level Forest Management Guidelines; M - Mitigation; LL-DVC – LLBO desired vegetation condition</i>
stabilize exposed soil.				
Retain and avoid excessive piling of the existing forest floor, litter layer, root systems, and mineral soil surface.	Mechanical activities, pile burning, prescribed burning	Everywhere	All	Forest Plan Standard Retain Soil Nutrients
Maintain filter strips around wetlands and open water. Limit soil disturbance in the filter strip to <5% of the area and avoid concentrating disturbance at any one location. Filter strip widths vary by slope: 50 feet for slopes <=10%; 70 feet for slopes 11-17%; and 150 feet for slopes >=18%.	Mechanical harvest activities	Wetlands and open waters	All	MFRC 2012, General Guidelines, Table GG-1 G-WS-4, p.2-14
Avoid placement of slash or felled trees in wetlands and open water. Also, avoid placement of temporary roads, skid trails, or log landings, in wetlands and within 200 feet of open water. Consult with the local hydrologist regarding additional mitigation requirements when avoidance is not feasible.	Mechanical harvest activities	Wetlands and open waters	All	S-WS-5, p.2-14
Harvest is not allowed within 200 feet of open water.	Mechanical harvest activities	Wetlands and open waters	All	S-WS-9, p. 2-15; MFRC 2012, General Guidelines, Table GG-1
Where harvesting is allowed, retain a minimum of 60 square feet basal area per acre (using gap-clump or distributed tree retention) within 200 feet of open water. Favor retention of larger diameter	Mechanical harvest activities	Within 200 feet of open waters	All	O-WS-4, p.2-12; MFRC 2014, p.50 MFRC 2012, General

Design Element	Activity <i>that needs to be modified</i>	Where? <i>applicable area</i> <i>(geographic features, forest types, management areas, etc.)</i>	When? <i>Timing when element is needed.</i>	Source/Reference/Code <i>S - Forest Plan Standard; G – Forest Plan Guideline; O – Forest Plan Objective; MFRC- Site-level Forest Management Guidelines; M - Mitigation; LL-DVC – LLBO desired vegetation condition</i>
and/or longer-lived tree species suitable to ecological site conditions. Create or retain a minimum of 4 leave logs per acre, favoring those that are 6 feet or longer and greater than 6 inches in diameter.				Guidelines, p.79
Avoid mechanical fuels treatments and hard fireline construction in wetlands or wet soils, on slopes greater than 18%, and within 100 feet of open water; and stabilize exposed soils along hard firelines when treatment activities have been completed. Consult with the local hydrologist regarding soil moisture and slope conditions or additional mitigation requirements when avoidance is not feasible.	Mechanical fuels activities and prescribed fire	Wetlands or wet soils, within 100 feet of open water	All	
WILDLIFE				
Minimize activities that may disturb red-shoulder hawk or northern goshawk nesting sites during nesting season (from April 1- August 15)	All activities	Nesting sites	April 1-August 15	G-WL-24
Regulate tree removal or other activities if they are conducted within ¼ mile of an entrance to a known NLEB hibernaculum or within 150 feet of a known NLEB maternity roost tree.	All activities	¼ mile of NLEB hibernaculum or 150 feet of maternity roost tree	April 1 – October 31	USFWS Federal 4(d) Rule
Rusty-patched bumblebee - Conduct management activities that are within the low potential and high potential zones outside of the pollinating/nesting window of March 1- October 15th, unless cleared by USFWS.	All activities	Low potential and high potential zones	March 1 – October 15th	O-WL-4

Chippewa National Forest – Fire Dependent Ecosystem Restoration Project – Detailed Proposed Action

Design Element	Activity <i>that needs to be modified</i>	Where? <i>applicable area</i> <i>(geographic features, forest types, management areas, etc.)</i>	When? <i>Timing when element is needed.</i>	Source/Reference/Code <i>S - Forest Plan Standard; G – Forest Plan Guideline; O – Forest Plan Objective; MFRC- Site-level Forest Management Guidelines; M - Mitigation; LL-DVC – LLBO desired vegetation condition</i>
AIR QUALITY				
Maintain the ambient air on the Forest within the National Ambient Air Quality Standards and the Minnesota Ambient Air Quality Standards.	Prescribed Burning	Forest Wide	All Seasons	O-AQ-1
Prescribed burning activities on the National Forest will only be conducted if they comply with requirements of the most current Minnesota Smoke Management Plan.	Prescribed Burning	Forest Wide	All Seasons	S-AQ-1
The Minnesota Smoke Management Plan (SMP) is designed to mitigate the nuisance and public safety hazards posed by prescribed fire and managed wildfire activities in the state of Minnesota. The SMP outlines guidance and best practices to limit smoke intrusions into populated areas, prevent deterioration of air quality and National Ambient Air Quality Standards (NAAQS) violations, and address visibility impacts in federal mandatory Class I areas.	Prescribed Burning	Forest Wide	All Seasons	https://mnics.org/wppress/left-sidebar-menu/administrative/wp-content/uploads/2012/03/Smoke-Mangement-Plan.pdf https://www.dnr.state.mn.us/rx/fire/forms.html
USFS Region 9: Prescribed Fire Resumption Process. Mitigations and procedures to implement Rx fire activities during the Covid-19 pandemic.	Prescribed Burning	Forest Wide	All Seasons	5100: Eastern Region (R9) Prescribed Fire Resumption Process. (Regional Forester to Forest Supervisors)
HERITAGE				
Identify, evaluate, protect, monitor, and preserve heritage resources.	All	Management Areas	All	O-HR-1; M-HR-1
Verify area of potential effect (management area) has been surveyed for heritage				

Chippewa National Forest – Fire Dependent Ecosystem Restoration Project – Detailed Proposed Action

Design Element	Activity <i>that needs to be modified</i>	Where? <i>applicable area (geographic features, forest types, management areas, etc.)</i>	When? <i>Timing when element is needed.</i>	Source/Reference/Code <i>S - Forest Plan Standard; G – Forest Plan Guideline; O – Forest Plan Objective; MFRC- Site-level Forest Management Guidelines; M - Mitigation; LL-DVC – LLBO desired vegetation condition</i>
resources to the current standard. No treatments in areas that have not been surveyed to current standards.				
<p>Historic properties (heritage resources/sites & cultural resources/sites) to be protected include protected areas ("buffers") beyond known site limits, determined on a case-by-case basis considering landform, vegetative cover, access, and planned project activities.</p> <p>Standard protection of historic properties will delineate site area with flagging or paint. No activities within the area of the site to be protected.</p>	All	Heritage Resource within Management Areas	All	<p>S-HR-9; M-HR-2; M-HR-3.</p> <p>See also O-TR-4, O-TR-5, & S-TR-3 in reference to cultural resources and tribal issues of interest.</p>
Consult, as provided for by law, with Tribes in order to address tribal issues of interest and National Forest management activities and site-specific proposals.	All	All	All	O-TR-4, O-TR-5, & S-TR-3

References

- Brose, P., Schuler, T., Van Lear, D., & Berst, J. (2001). Bringing fire back: the changing regimes of the Appalachian mixed-oak forests. *Journal of Forestry*, 99(11), 30-35.
- Guyette, R., Gallagher, T., Dey, D., & Stambaugh, M. (2014). *Three Centuries of Fire History at Norway Beach*. Columbia, MO: USDA Forest Service Northern Research Station, University of Missouri, Missouri Tree-Ring Laboratory.
- Guyette, Richard; Gallagher, Theresa; Palik, Brian; Dey, Daniel; Stambaugh, Michael; and The Missouri Tree-Ring Laboratory. (2015). *Early fire history at the Cutfoot Experimental Forest near Grand Rapids, Minnesota*. Columbia, MO: USDA Forest Service, Northern Research Station.
- Hanberry, B. B., Palik, B. J., & He, H. S. (2012). Comparison of historical and current forest surveys for detection of homogenization and mesophication of Minnesota forests. *Landscape Ecology*, 27(10), 1495-1512.
- Henning, S. J., & Dickmann, D. I. (1996). Vegetative Responses to Prescribed Burning in a Mature Red Pine Stand. *Northern Journal of Applied Forestry*, 140-146.
- Kipfmüller, K. (2020, January 13). Draft Figure of Fire Events on Star Island. *Forthcoming*.
- Minnesota Department of Natural Resources. (2003). *Field Guide to the Native Plant Communities of Minnesota: the Laurentian Mixed Forest Province*. St. Paul, MN: Ecological Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR.
- Palik, B. (2020, March). Natural Models for Red Pine Silviculture. *Powerpoint*. Grand Rapids, Minnesota: USDA Forest Service, Northern Research Station.
- Palik, B. J., D'Amato, A. W., Franklin, J. F., & Johnson, K. N. (2020). *Ecological Silviculture: Foundations and Applications*. Waveland Press.
- USDA Forest Service Chippewa National Forest. (1997). *Chippewa National Forest's Landtypes*. Cass Lake, MN: Chippewa National Forest.
- USDA Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands. Volume 1: National Core BMP Technical Guide. FS-990a. Available at: https://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

Appendix A

Existing Condition Assessment

This dichotomous key can be used to determine the condition of a stand(s) within a management area. This key was derived from interpretations provided by both the Chippewa National Forest's Landtype (USDA Forest Service Chippewa National Forest, 1997) descriptions and the Field Guide to the Native Plant Communities of Minnesota (Minnesota Department of Natural Resources, 2003). If the following descriptions are too brief, further information can be consulted from either source document.

1. Water table below mineral surface (no standing water); or if above, temporarily **1.1 Uplands**
 - 1.1. Soils sorted, sandy (glacial outwash, kames, eskers, deltas), well-drained to excessively drained; forest canopy dominated by fire-dependent species (Table 5**Error! Reference source not found.**), well-defined subcanopy typically absent, few seedlings of canopy trees present, fire-dependent plant indicators present (Table 8**Error! Reference source not found.**), prairie plants sometimes persist in maturing stands **Fire-dependent; Jack Pine, Red Pine, Great Lakes Pine, Mixed Pine/Ha**
 - 1.1.1. Groundpines, groundcedar, fly honeysuckle, understory balsam fir, and/or bunchberry present; almost never has bur oak **Northern Floristic Region**
 - 1.1.2. Big bluestem, blue giant hyssop, poison ivy, and/or spreading dogbane present; almost never has balsam fir or white spruce **Central Floristic Region**
 - 1.2. Soils unsorted, loamy moraines and till plains/ground moraines, moist, well-drained to somewhat poorly drained; older forests with well-defined canopy, sub-canopy, and shrub layers; canopy dominated by mesic hardwood species (Table 5) large populations of canopy tree seedlings, prairie plants absent **1.2.1 Mesic Hardwoods**
 - 1.2.1. Stands are a mosaic of fire-dependent and mesic hardwood vegetation; variability in soils, topography, and waterbodies facilitate fire spread (continuous tracts of uplands/few waterbodies, sandy soil inclusions, mild topography), both fire-dependent and mesic hardwood plant indicators present (Table 8**Error! Reference source not found.**) **Fire Tolerant; White Pine**
 - 1.2.1.1. Naked miterwort, groundpines, wild ginger, understory balsam fir, bluebead lily, and lady fern present; almost never has blackcherry or hackberry **Northern Floristic Region**
 - 1.2.1.2. Black cherry, carrion-flowers, and hog peanut present; almost never has balsam fir, yellow birch, black ash, white spruce, or white cedar **Central Floristic Region**
 - 1.2.2. Mature stands are almost exclusively mesic hardwood obligates and facultative lowland conifer (Table 5), exclusively mesic hardwood plant indicators are present (Table 8) **Error!**

Reference source not found., variability in soils, topography, and waterbodies restrict spread of fire (interrupted connectivity of uplands, soils less well-drained, many waterbodies less variable)**Fire Intolerant; Northern Hardwood, Northern Hardwood/Conifer, White Cedar**

2. Water table at or above mineral surface throughout most of the year. Soils very poorly drained and/or saturated, soils mucky or peaty**2.1 Lowlands**

2.1. Lowland forest species >25% cover and/or significant moss cover (i.e. non-forested bogs, fens, and alder swamps)**Disturbance Intolerant; Northern Hardwood, Northern Hardwood/Conifer, White Cedar**

2.2. Lowland forest species <25% cover; moss cover minimal; dominated by wide-leaved graminoids <3 feet tall with occasional woody shrubs; seasonally flooded edges of shallow basins and streams, drainage areas, or slope base; mineral or muck soil; often adjacent to fire-dependent/tolerant uplands**Disturbance dependent; Wet Meadow**

Table 5: Canopy species of forest systems adapted from Guide to Native Plant Communities of Minnesota (Minnesota Department of Natural Resources, 2003)

Upland Forests			Lowland Forests		
Tree Species	Fire-dependent	Mesic Hardwoods	Wet Forest	Rich Peatland	Acid Peatland
American elm	-	Facultative	Facultative	-	-
Aspen	Facultative	Facultative	-	-	-
Balsam fir	Facultative	Facultative	Facultative	Facultative	-
Basswood	-	Obligate	-	-	-
Black ash	-	-	Facultative	Facultative	-
Black spruce	-	-	-	Facultative	Facultative
Bur Oak	Facultative	Facultative	-	-	-
Jack pine	Obligate	-	-	-	-
Paper birch	Facultative	Facultative	Facultative	Facultative	-
Pin Oak	Obligate				
Red Oak	-	Obligate	-	-	-
Red pine	Obligate	-	-	-	-
Sugar maple	-	Obligate	-	-	-
Tamarack	-	-	Facultative	Facultative	Facultative
White cedar	-	Facultative	Facultative	Facultative	-
White pine	Facultative	Facultative	-	-	-
White spruce	Facultative	Facultative	Facultative	-	-
Bold Species May Provide > 25% Cover of Community					
Normal Species May Provide from 10% - 25% Cover of Community					
"Obligate" species occur almost exclusively within a particular community type, with less than 10% in any other community type					
"Facultative" species are capable of occurring in multiple community types and may exist at greater than 10% in other community types.					

Desired Conditions

Desired Disturbance: Fire Restored as an Ecosystem Process

Table 6: Fire Intensity Frequencies

Fire-dependent Landtypes	Fire-tolerant Landtypes / Mesic Hardwoods	Disturbance Dependent Lowland Landtypes / Wet meadows
Moderate Surface Fires¹ Northern Region: 42-115 years Central Region: 22-25 years	Moderate Surface Fires¹ Northern Region: 130-160 years Central Region: 40-160 years	Moderate Surface Fires¹ Moderate surface fires, in conjunction with flooding events, provide relatively frequent disturbance. Disturbance is frequent enough to prevent trees and/or shrubs from dominating.
Stand-Regenerating Fires Northern Region: 170-220 years Central Region: 110-130 years	Stand-Regenerating Fires Northern Region: 430->1,000 years Central Region: 370-1000 years	

¹Local fire intervals have been estimated at 8.3 to 15.2 years from research conducted at the Cutfoot Experimental Forest and Norway Beach (Guyette et. al. 2015)

Desired Structure: Cover by Strata for Mature to Older Forests

Table 7: Cover by Strata¹

Fire-dependent Landtypes	Fire-tolerant Landtypes / Mesic Hardwoods	Disturbance Dependent Lowland Landtypes / Wet meadows
Canopy 25% to 100%, typically 50%-100%. A range from 0% to 50% within preforests; constituting about 2%-5% of area ² .	Canopy 25% to 100%, typically 50% to 100%. A range from 0% to 75% within reforests: constituting <1% of area ² .	Canopy 0% to 25%, typically 0%
Sub-canopy 0% to 50%, typically 0%-5%	Sub-canopy 0% to 75%, typically 25% to 50%	Sub-canopy 0%
Shrub Layer 5%-100%, typically 5% to 50%	Shrub Layer 25% to 100%, typically 25% to 50%	Shrub Layer 0% to 50%, typically 5% to 25%
Ground Layer 5% to 100%, typically 50% to 100%	Ground Layer 25% to 100%, typically 25% to 50%	Ground Layer 50% to 100%, typically 100%

¹Cover Class Descriptions: Absent (0%-5%), Sparse (5%-25%), Patchy (25%-50%), Interrupted (50%-75%), Continuous (75%-100%)

²Range of preforest area based on five-year existence and both the shortest and longest stand regenerating frequency (e.g. 5 years / 220 years = 2.3% and 5 years / 110 years = 4.5%; range of fire-dependent preforest area about 2%-5% of total area)

Desired Composition: Common and Characteristic Diversity

This collection of desirable species is based on the best available information. If new information indicates that species should either be added or removed from this table, such species could be considered through a Supplemental Information Report. If the findings of that report indicate that the addition or removal of such species is within the scope and range of effects of this analysis, then the deciding official may determine that no correction, supplement, or revision of this environmental document is needed in order for this table to adopt those changes.

Table 8: Documented Ground-Layer Flora Representative of Landtypes¹

Bold: Common Cover Species

Normal: Characteristic Species of Landtype

Fire-dependent Landtypes		Fire-tolerant Landtypes / Mesic Hardwoods		Disturbance Dependent Lowland Landtypes / Wet Meadows	
Scientific name	Common name	Scientific name	Common name	Scientific name	Common name
Forbs		Forbs		Forbs	
<i>Achillea millefolium</i>	Yarrow	<i>Amphicarpaea bracteata</i>	Hog peanut	<i>Acorus calamus</i>	Sweet flag
<i>Antennaria</i> spp.	Pussytoes	<i>Anemone americana</i>	Round-lobed hepatica	<i>Asclepias incarnata</i>	Swamp milkweed
<i>Apocynum androsaemifolium</i>	Spreading dogbane	<i>Anemone quinquefolia</i>	Wood anemone	<i>Campanula aparinoides</i>	Marsh bellflower
<i>Aquilegia canadensis</i>	Columbine	<i>Aralia nudicaulis</i>²	Wild sarsaparilla	<i>Cicuta bulbifera</i>	Bulb-bearing water hemlock
<i>Aralia nudicaulis</i>²	Wild sarsaparilla	<i>Aralia racemosa</i>	American spikenard	<i>Epilobium leptophyllum</i>	Linear-leaved willowherb
<i>Arctostaphylos uva-ursi</i> ³	Bearberry	<i>Asarum canadense</i>	Wild ginger	<i>Epilobium palustre</i>	Marsh willowherb
<i>Asclepias ovalifolia</i>	Oval-leaved milkweed	<i>Aster macrophyllus</i>²	Large-leaved aster	<i>Epilobium strictum</i>	Downy willowherb
<i>Aster ciliolatus</i>	Lindley's aster	<i>Caulophyllum thalictroides</i>	Blue cohosh	<i>Eupatorium maculatum</i>	Spotted Joe pye weed
<i>Aster laevis</i>	Smooth blue aster	<i>Clintonia borealis</i>²	Bluebead lily	<i>Lathyrus palustris</i>	Marsh vetchling
<i>Aster macrophyllus</i>²	Large-leaved aster	<i>Desmodium glutinosum</i>	Pointed-leaved tick trefoil	<i>Lycopus americanus</i>	Cut-leaved bugleweed
<i>Aster oolentangiensis</i>	Skyblue aster	<i>Galium triflorum</i>	Sweet-scented bedstraw	<i>Lysimachia terrestris</i>	Yellow loosestrife
<i>Campanula rotundifolia</i>	Harebell	<i>Lathyrus ochroleucus</i>	Pale vetchling	<i>Lysmachia thyrsiflora</i>	Tufted loosestrife
<i>Chimaphila umbellata</i> ³	Pipsissewa	<i>Maianthemum canadense</i>²	Canada mayflower	<i>Mentha arvensis</i>	Common mint
<i>Clintonia borealis</i>²	Bluebead lily	<i>Osmorhiza claytonii</i>	Clayton's sweet cicely	<i>Polygonum amphibium</i>	Water smartweed
<i>Cornus canadensis</i>	Bunchberry	<i>Polygonatum pubescens</i>	Hairy Solomon's seal	<i>Polygonum sagittatum</i>	Arrow-leaved tearthumb
<i>Epigaea repens</i>	Trailing arbutus	<i>Pyrola elliptica</i>	Elliptic shinleaf	<i>Potentilla palustris</i>	Marsh cinquefoil
<i>Epilobium angustifolium</i>	Fireweed	<i>Rubus pubescens</i>	Dwarf raspberry	<i>Rumex orbiculatus</i>	Great water dock
<i>Fragaria virginiana</i>	Common strawberry	<i>Sanguinaria canadensis</i>	Bloodroot	<i>Scutellaria galericulata</i>	Marsh skullcap

Chippewa National Forest – Fire Dependent Ecosystem Restoration Project – Detailed Proposed Action
Appendix A: Conditions Assessment and Management Protocol

<i>Galium boreale</i>	Northern bedstraw	<i>Sanicula marilandica</i>	Maryland black snakeroot	<i>Solidago gigantea</i>	Giant goldenrod
<i>Gaultheria procumbens</i> ³	Wintergreen	<i>Smilacina racemosa</i>	Common false Solomon's seal	<i>Stellaria longifolia</i>	Long-leaved chickweed
<i>Heuchera richardsonii</i>	Alumroot	<i>Solidago flexicaulis</i>	Zigzag goldenrod		
<i>Lathyrus venosus</i>	Veiny Pea	<i>Streptopus roseus</i>	Rose twistedstalk		
<i>Linnaea borealis</i>	Twinsflower	<i>Thalictrum dioicum</i> ²	Early meadow-rue		
<i>Lithospermum canescens</i>	Hoary puccoon	<i>Trillium grandiflorum</i>	Large-flowered trillium		
<i>Maianthemum canadense</i> ²	Canada mayflower	<i>Uvularia grandiflora</i>	Large-flowered bellwort		
<i>Melampyrum lineare</i>	Cow wheat	<i>Uvularia sessilifolia</i>	Pale bellwort		
<i>Physalis virginiana</i>	Virginia ground cherry	<i>Viola canadensis</i>	Rugulose violet		
<i>Senecio pauperculus</i>	Balsam ragwort	<i>Viola pubescens</i>	Yellow violet		
<i>Solidago hispida</i>	Hairy goldenrod				
<i>Thalictrum dioicum</i> ²	Early meadow-rue				
<i>Vaccinium angustifolium</i> ³	Lowbush blueberry				
Graminoids		Graminoids		Graminoids	
<i>Andropogon gerardii</i>	Big bluestem	<i>Brachyelytrum erectum</i>	Bearded shorthusk	<i>Calamagrostis canadensis</i>	Bluejoint
<i>Carex pennsylvanica</i> ²	Pennsylvania sedge	<i>Carex arctata</i>	Drooping wood sedge	<i>Carex lacustris</i>	Lake sedge
<i>Danthonia spicata</i>	Poverty grass	<i>Carex pennsylvanica</i> ²	Pennsylvania sedge	<i>Carex stricta</i>	Tussock sedge
<i>Oryzopsis asperifolia</i> ²	Mountain rice grass	<i>Luzula acuminata</i>	Pointed woodrush	<i>Carex utriculata</i>	Beaked sedge
<i>Oryzopsis pungens</i>	Sharp-pointed rice grass	<i>Oryzopsis asperifolia</i> ²	Mountain rice grass	<i>Scirpus cyperinus</i>	Woolgrass
<i>Schizachne purpurascens</i>	False melic grass				
Ferns & Fern Allies		Ferns & Fern Allies		Ferns & Fern Allies	
<i>Pteridium aquilinum</i> ²	Bracken fern	<i>Athyrium filix-femina</i>	Lady fern	<i>Onoclea sensibilis</i>	Sensitive fern
		<i>Botrychium virginianum</i>	Rattlesnake fern	<i>Thelypteris palustris</i>	Northern marsh fern
		<i>Osmunda claytonia</i>	Interrupted fern		
		<i>Pteridium aquilinum</i> ²	Bracken fern		

¹These species are provided in the Field Guide to the Native Plant Communities of Minnesota as either common and/or characteristic of the forest system (either a common cover species as documented for individual system descriptions pp. 97-159 and pp. 289-293; and/or provided in Appendix B or Appendix C as a species that achieves maximum frequencies, at or above ten percent, from that ecological system and is useful for differentiating between ecological systems). Many other species expected to occur at lower frequency that may also be desirable components to promote within the plant community.

²Species commonly occurs as cover in both fire-dependent and mesic hardwood systems.

³Species is a low shrub but is provided as a common ground-layer species within fire-dependent composition descriptions.

Management Protocol

Treatment Guide

After verifying the condition of a site-specific project area, the following key identifies potential actions to address any difference that may exist between the existing and desired condition. Ranges refer to those described for each group in **Error! Reference source not found.**, while characteristic ground-layer flora are presented in **Error! Reference source not found.**.

1. Fire disturbance as an ecosystem process, is outside of the desired range, (e.g. average frequency of moderate surface fires from northern floristic region of fire-dependent landtype is 42-115 years: with no known fire occurrence in past 126 years, up to three fires within the 15-year lifespan of this project could occur)
 - 1.1. Canopy, sub-canopy and/or shrub layer average cover greater than desired range.... **Treatment A**
 - 1.2. Canopy, sub-canopy and/or shrub layer average cover within the desired range..... **Treatment B**
2. Fire disturbance as an ecosystem process is within the desired range, (e.g. average frequency of moderate surface fires from northern floristic region of fire-dependent landtype is 42-115 years: at least one fire occurrence within the past 115 years)
 - 2.1. Canopy, sub-canopy, and shrub layers greater than characteristic range of cover **Treatment C**
 - 2.2. Canopy, sub-canopy, and shrub layer less than or within range of characteristic cover
 - 2.2.1. Ground-layer cover less than desired range (includes common and characteristic species) and/or less than ten percent of characteristic species of the landtype present **Treatment D**
 - 2.2.2. Ground layer cover within desired range (includes common and characteristic species), greater than ten percent of characteristic diversity of the landtype present **No Treatment Needed**

Management Treatments

Treatment A

Existing Condition: Fire disturbance as an ecosystem process outside of the desired range, excessive canopy, sub-canopy and/or shrub growth, potentially stifled ground-layer abundance and diversity.

Objective: Restore fire as an ecosystem component, decrease sub-canopy and/or shrub layer cover, and increase richness and abundance of fire-dependent/tolerant ground-layer flora.

Implementable Actions:

- Prescribe fire to restore ecosystem component; preference is for annual prescribed fires during growing season and at times with low soil moisture content to reduce shrub cover.
- Harvest treatments may be used to reduce canopy density to promote desirable understory cover and diversity which is suitable for the involved cover type. The goal would be to conduct the harvest prior to burning for the purposes of reducing fire behavior by removing additional fuels as well as allowing for a more discriminate location of vegetation management. In addition, the burning conditions would be improved and more effective by opening the understory.
- Mechanical treatments to further suppress shrub growth.
- Sow or transplant native species appropriate for the landtype (e.g. Table 8).
- Monitor vegetative response in subsequent growing seasons. Reevaluate system with floristic response to treatment. Repeat decision tree and continue treatments until No Treatment Needed.

Treatment B

Existing Condition: Fire disturbance as an ecosystem process outside of the desired range, potentially stifled ground-layer abundance and diversity

Objectives: Restore fire as an ecosystem component, maintain sub-canopy and/or shrub layer, and increase richness and abundance of ground-layer flora

Implementable Actions:

- Prescribe fire to restore ecosystem component; preference is for biennial, or less frequent, prescribed fire in either growing or dormant season.
- Sow or transplant native species appropriate for the landtype (e.g. Table 8).
- Monitor vegetative response in subsequent growing seasons. Reevaluate system with floristic response to treatment. Repeat decision tree and continue treatments until No Treatment Needed.

Treatment C

Existing Condition: Fire disturbance as an ecosystem process within the desired range, however canopy, sub-canopy, and/or shrub densities exceed objectives. Potentially stifled ground-layer abundance and diversity.

Objectives: Decrease canopy, sub-canopy, and/or shrub layer cover, and increase richness and abundance of fire-dependent/tolerant ground-layer flora.

Implementable Actions:

- Harvest treatments may be used to reduce canopy density to promote desirable understory cover and diversity which is suitable for the involved cover type.
- Utilize hydro-ax, brush saws, chainsaws or lopping shears to manually reduce sub-canopy and/or shrub cover.
- Repeat mechanical treatments multiple times within the same growing season to exhaust stored carbohydrates.
- Sow or transplant native species appropriate for the landtype (e.g. Table 8).
- Monitor vegetative response in subsequent growing seasons. Reevaluate system with floristic response to treatment. Repeat decision tree and continue treatments until No Treatment Needed.

Treatment D

Existing Condition: Fire disturbance as an ecosystem process within the desired range, and canopy, sub-canopy, and shrub cover consistent with objective range, yet ground layer cover and characteristic flora remains low. Seed bank potentially has insufficient viable seed.

Objectives: Increase abundance and richness of ground-layer flora

Implementable Actions:

- Sow or transplant native species appropriate for the landtype (e.g. Table 8).
- Mechanical site preparation for seeding, could include tilling, mowing, fecon.
- Monitor vegetative response in subsequent growing seasons. Reevaluate system with floristic response to treatment. Repeat decision tree and continue treatments until No Treatment Needed.